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CERNET

The Progress Report of Supercomputing Internet Project based on CERNET2 (IPv6)(HPC6)



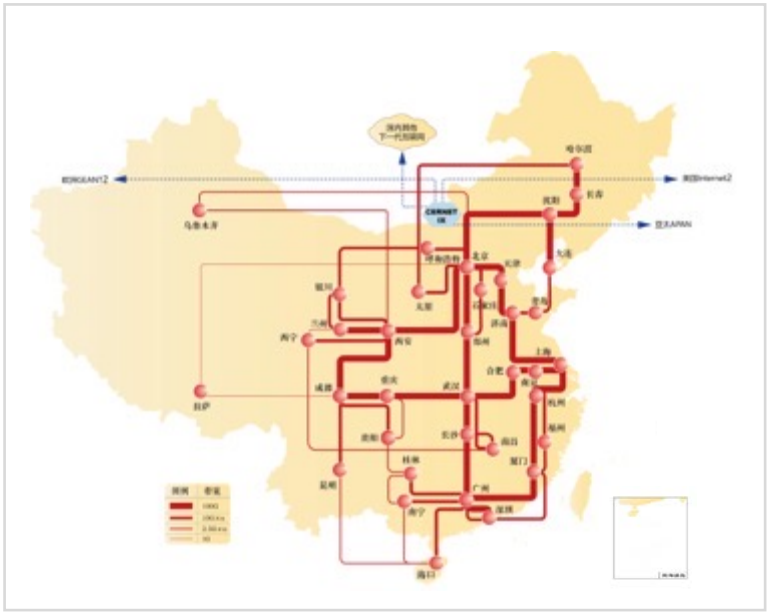
CERNET HPC6 Team

Feb. 28, 2024

Gao Yan

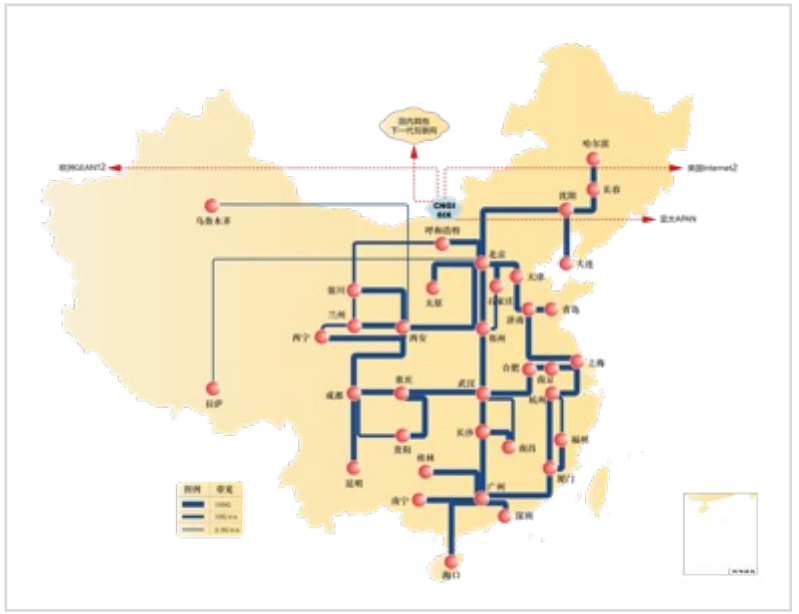
Two Backbone Networks of CERNET

IPv4：CERNET



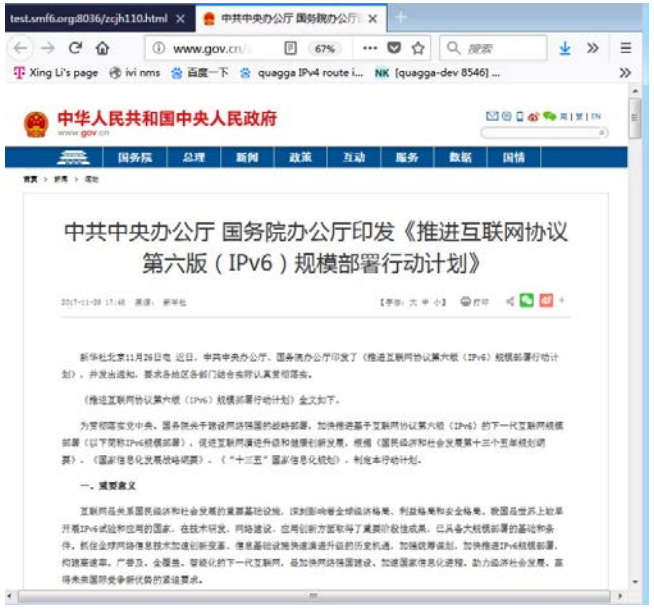
- IPv4 network protocols
- 38 core nodes
- Covering 31 provinces
- 100G band width of trunk lines
- More than 3.15T total bandwidth
- More than 20 million users

IPv6：CERNET 2



- IPv6 network protocols
- 41 core nodes
- Covering 31 provinces
- 100G band width of trunk lines
- More than 4.18T total bandwidth
- More than 15 million users

Why We use CERNET 2-IPv6



1. The Chinese government is actively participating in the global development of IPv6





IPv4：CERNET

2. CERNET is a mature production network with many application resources.

3. excellent data transmission performance guarantees SCI "artery network system”



IPv6：CERNET 2

Three Major Types of Computing Power

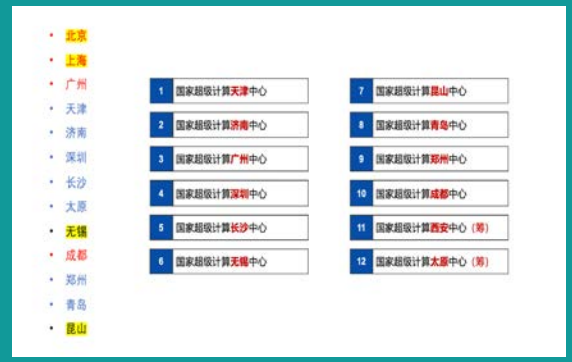
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Computing Power

- **Basic Computing Power** — consumer Internet, industry Internet, and government Internet, etc
  - 10 national integrated big data centers



- **Supercomputing Power** — scientific computing, engineering computing, and AI computing, etc
  - 13 national supercomputing centers



- **Intelligent Computing Power** — AI Computing: Machine learning, deep learning, data analytics, etc
  - More than 20 AI centers

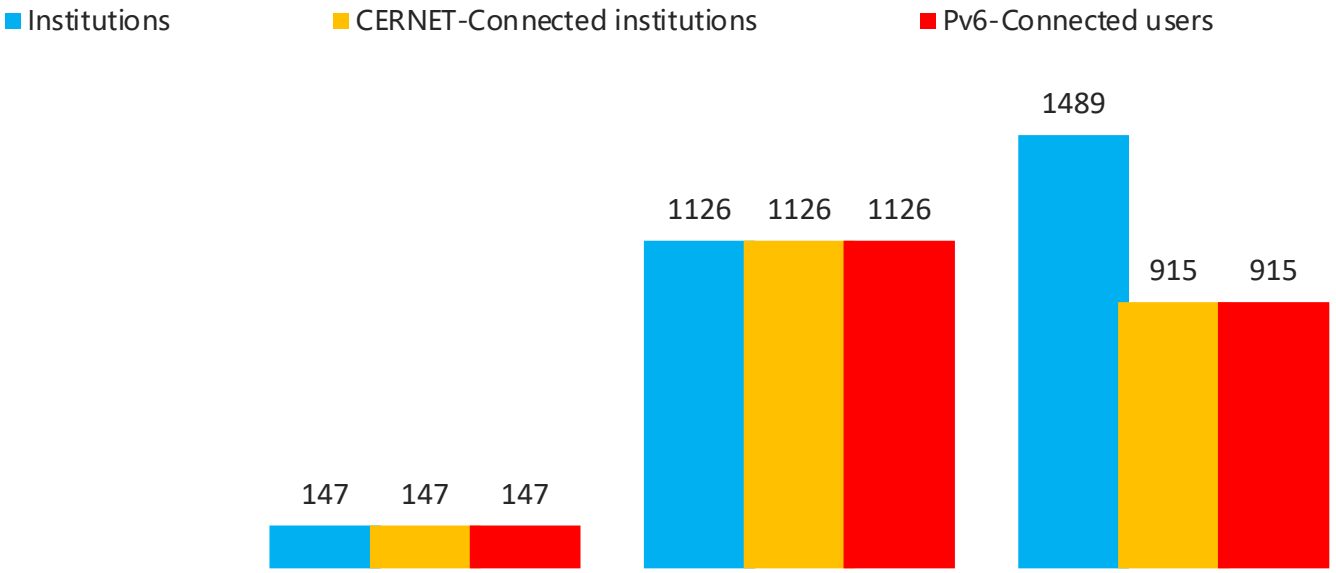


Nearly **3000**

higher educational institutions in China

Our Customers

2000+

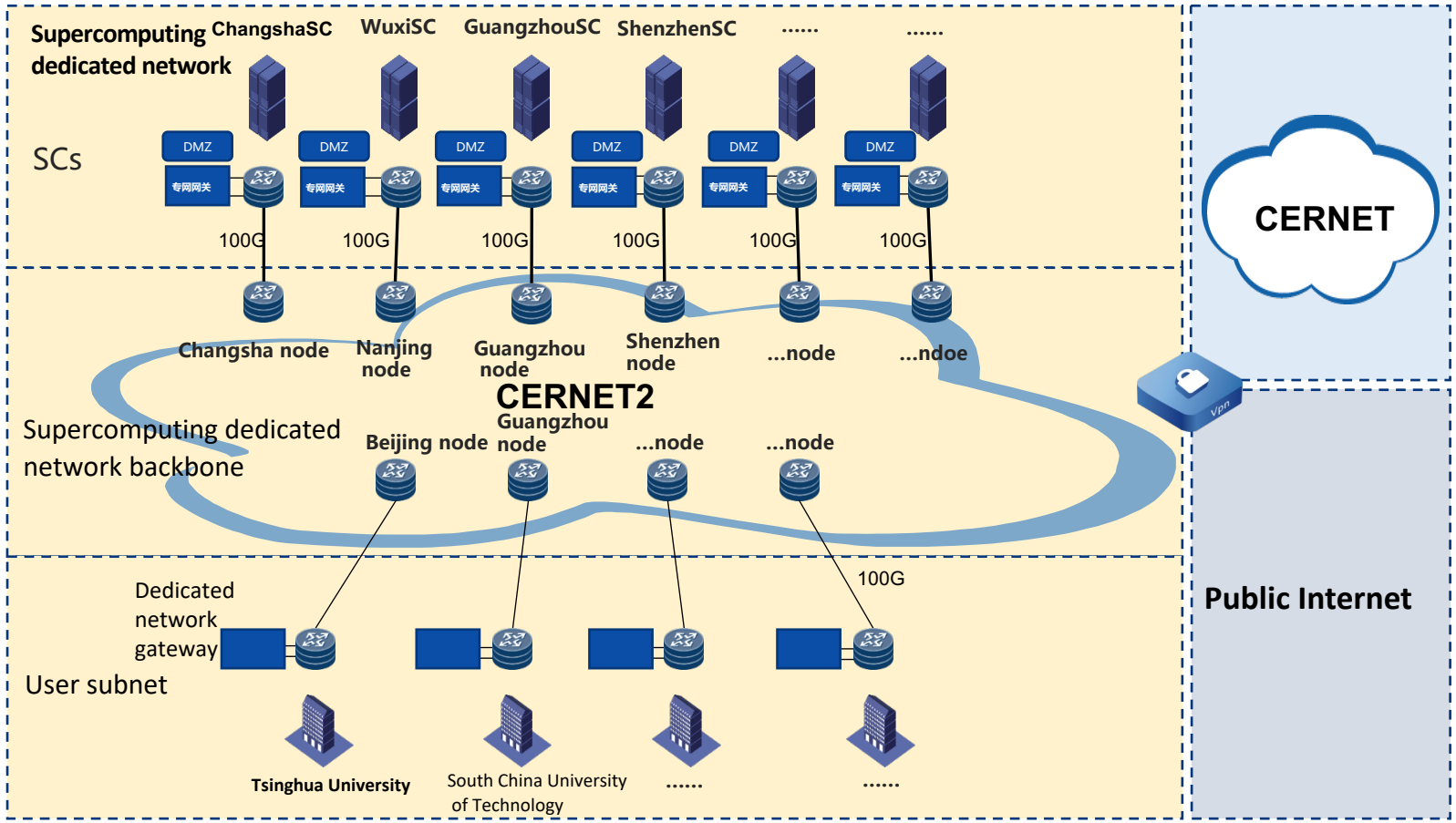


School Type	TOP-Class	Regular	Higher Vocational and Technical
CERNET User Covering Rate	**100.0%**	**100.0%**	**63.2%**

CERNET 2 basically covers undergraduate colleges and universities, which is the main user group of high performance computing.

Participate in Chinese Government Projects

"National Core Resource Network in HPC Environment " (2020)



Tasks :

- Connect SC nodes to CERNET2.
- the network aggregate computing capacity ≥ 2Eflops, storage ≥1EB.
- IVI tech. enable the transmission between IPv4 to IPv6 and IPv6 to IPv4, as well as IPv6 to IPv6.

Project progress:

- In this project, 4 supercomputing centers are connected to CERNET2 network with 10-100G bandwidth

User's Ddifficulties and Needs



Bandwidth & Computer Power limitation

IPv6 Support Issues

IVI is indispensable during the transition period from v4 to v6

Heterogeneous Platforms

- users need to spend a lot of time and energy to do the secondary compilation and the optimization of computing algorithms.

Lack of Professional One-Stop Service

- Users need professional services covering the whole process of using supercomputing resources, so that they can get timely response and solution when facing various problems.

Blueprint of Supercomputing Internet Project Based on CERNET2

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Users

Chinese universities | Chinese Research Institutions | Other Users in China | International Users

Operating Entity CERNET Corp.

Supercomputer Internet Computing power and Service Platform

Unified management platform

- Service Catalog: computing power; ...
- Workflow Approval: pending approval; approval records
- Personal Center: service request; trash can
- Sys. Mgmt.: operation logs; ...
- Cloud Vendor Mgmt.: cloud connectivity; resource pool
- Account Mgmt.: users; user groups; institutions; role mgmt.; user mapping
- Billing Statement: expense summary; bill; balance; consumption records
- Resource Mgmt.: computing power; ...
- Recharge Mgmt.: recharge service; billing and invoice synchronization

Tripartite Integration

- identity authentication: Single Sign-On authentication; data synchronization
- Unified Payment Platform: payment management; information push
- WeChat Official Account: Mobile access; message push

Application Center

- HPC Application Marketplace
- big data Marketplace
- industry application marketplace

Talent Development

- HPC video courses
- HPC Application Training
- HPC Experimental Platform

Resource Provider

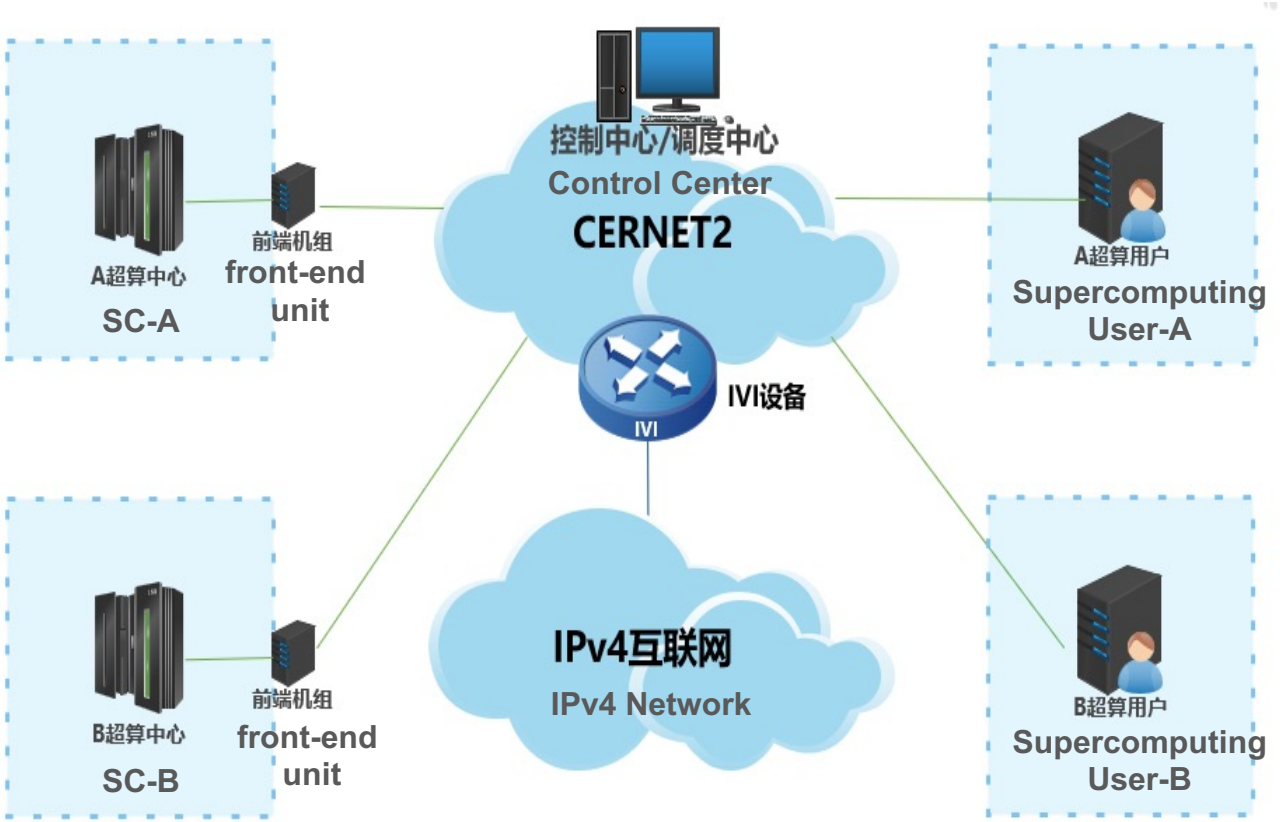
Cross-regional Distributed Computing Power Resources

Chinese National Computing Centers	Chinese universities' Computing Centers	Other Cloud Centers in China	International Cloud Centers
computing; storage; network	computing; storage; network	computing; storage; network	computing; storage; network

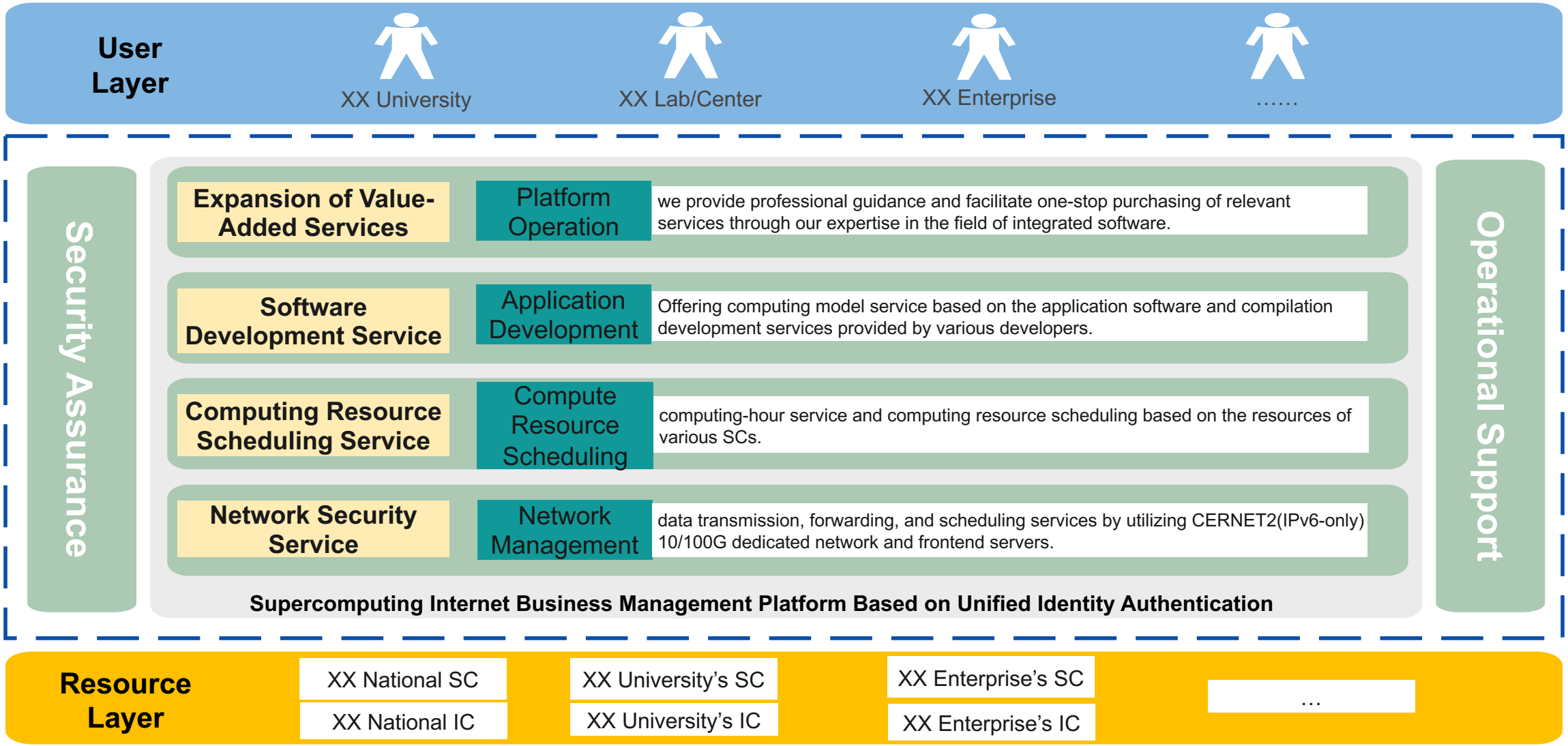
Network Architecture

The Network Topology Diagram of "Supercomputing Internet Computing Power and Service Platform"

- SCs are interconnected through a dedicated (or virtual dedicated) high-speed network provided by CERNET2, offering access bandwidth ranging from 10Gbps-100Gbps.
- The dedicated network doesn't interfere with the existing interconnection network structure within SCs.
- The platform supports user access via both IPv4 and IPv6, and its control and scheduling center make users and SCs share an unified management system.



The General Architecture of Platform



Building the Computing and Service Platform Based on CERNET2(IPv6) Network

Note：SC-Supercomputing certer; IC-Intelligent Computing.

Project Network Access Status

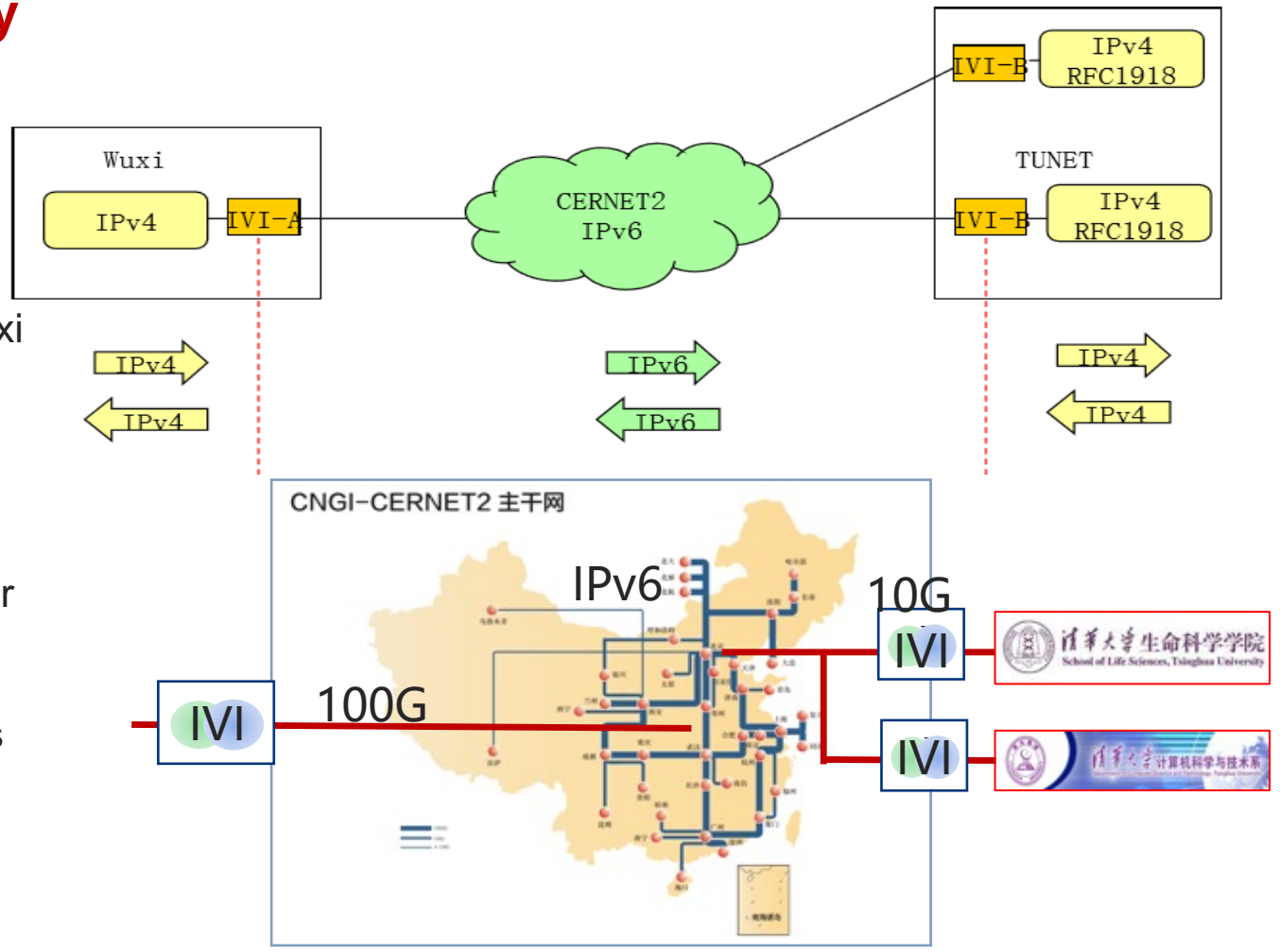
Supercomputing Center	IPv6	CERNET2 Node	Access Status
Wuxi	100G	Nanjing	100G（operational）
Guangzhou	10G	Guangzhou	10G（operational）
Changsha	10G	Changsha	10G（Testing）
Shenzhen	10G	Shenzhen	10G（Testing）
Chinese Academy of Sciences	10G	Beijing	10G（Testing）
Zhengzhou	10G	Zhengzhou	negotiating
Jinan	10G	Jinan	negotiating
Others	10G	Others	business expanding

- 2SCs have already connected to 10Gbps-100Gbps CERNET2(IPv6) network and are operational.
- The other 2SCs have completed the network access. Chinese Academy of Sciences (CAS) connected to CERNET2 via direct connection node of Beijing in backbone network.
- Negotiations are ongoing for the remaining SCs.

Test Case

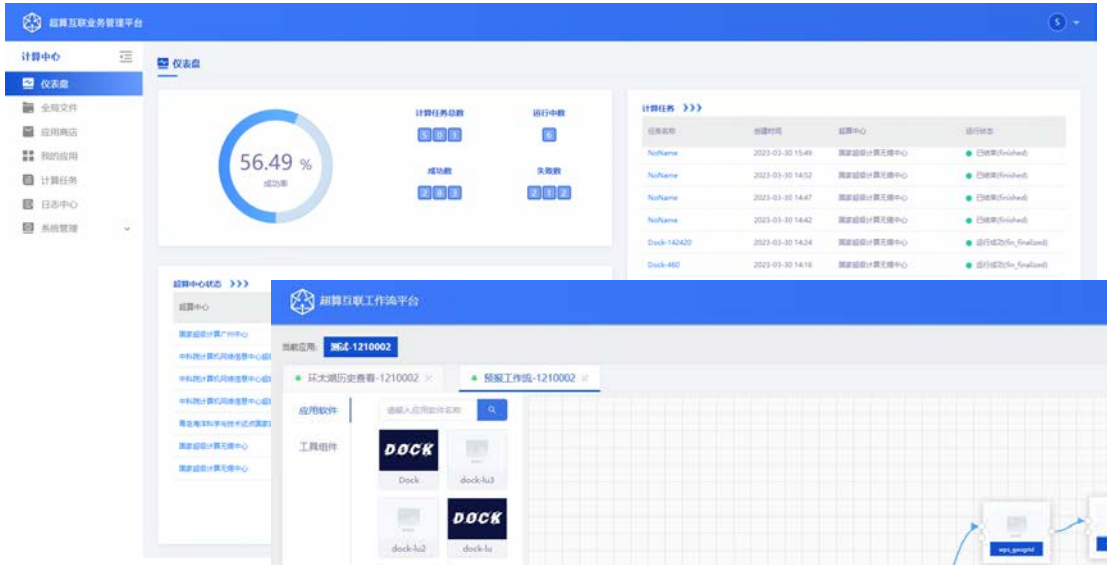
A high-speed dedicated data transmission channel for supercomputing center of Wuxi and user of Tsinghua University

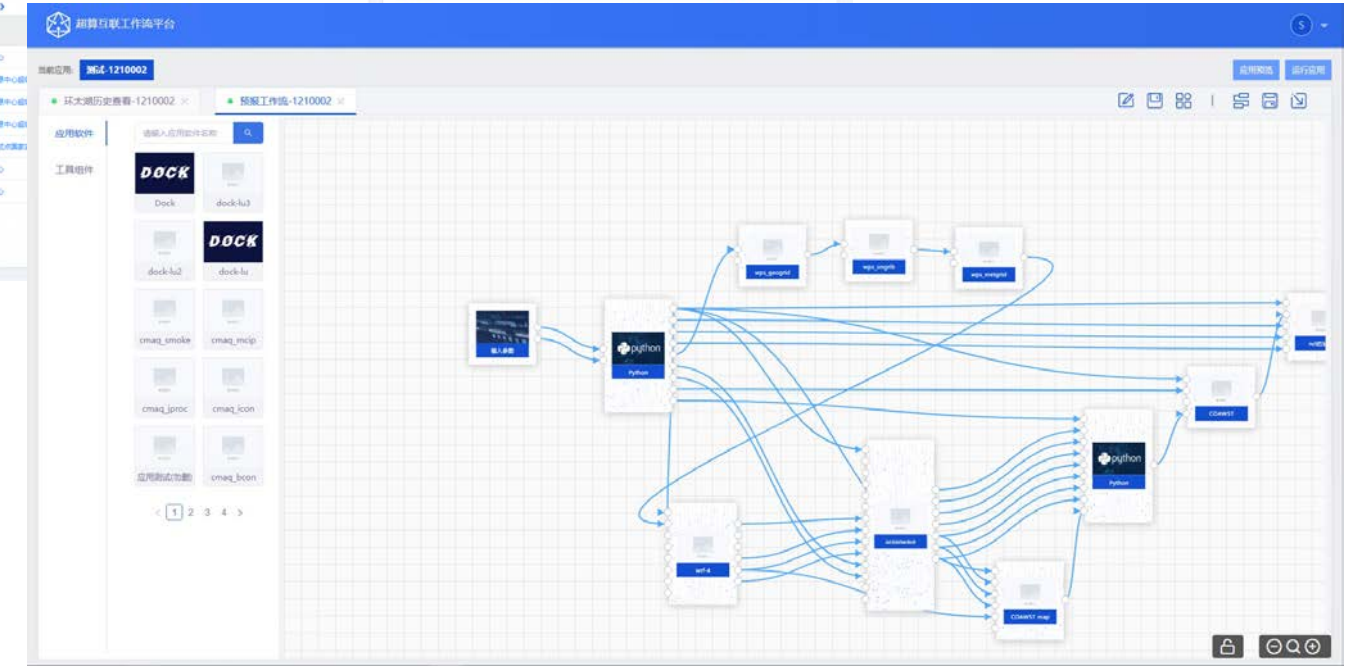
- Assist CERNET member- **Tsinghua University** Academy of Life Sciences transfer data with Wuxi Center.
- Good data transmission performance, Beijing to Wuxi single stream TCP rate can reach more than 8Gbps.
- Did not affect the campus network strategy; Good data transmission security; Both the supercomputer center and Tsinghua user didn't need to upgrade their application system.
- It realizes IPv4-IPv6-IPv4 and IPv6-IPv6 connections between Tsinghua University and Wuxi by utilizing Stateless IPv4/IPv6 translation technology IVI.



Service Platform Interface display

Computing Resource Scheduling Platform





Workflow Development Platform

1. Show the current operation states in the supercomputer Internet
2. Provide global file management
3. Provide app stores
4, provide user management, application review, role management, billing management and other functions

Next Step

Continue the Deployment of the SCs' Interconnection

- 2 large-scale SCs have connected to 10Gbps-100Gbps CERNET2 (IPv6) network, 2 SCs have network access contracts signed. The goal is to complete Internet access for 6 large-scale SCs as soon as possible.
- All 41 university nodes are connected, and further testing will be organized.



Trial Operation of Platform

- Select a subset of university users to participate in the platform's trial operation Based on the prior SCs' interconnection deployment.
- Monitor data transmission and continue to optimize performance.

Platform Development

- The initial framework design is completed, and subsequent work will focus on software upgrades, as well as support for bilingual use of Chinese and English.

Long-term Work

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- ✓ Continue to access CERNET2 network to large-scale SCs
- ✓ Establish billing mechanism for resource service of each SC.
- ✓ Marketing and promotion
- ✓ Establish billing mechanism for application stores of each SC.
- ✓ Maintain and continuously iterate the service platform.
- ✓ Management and control of WAN resource scheduling.
- ✓ Network security guarantee.




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Thank You!